The SPL SERIES is a high reliability line of single-output open frame and enclosed switching power supplies designed to operate from the wide range of AC power sources found worldwide. These models are designed to meet many Domestic and European regulatory agency requirements. These features simplify your inventory and service considerations by allowing the use of one standard power supply regardless of destination. If you plan to distribute your products world-wide, obtaining necessary agency approvals can be greatly simplified by specifying POWER-ONE SPL Series Switching Power Supplies.

Power-one

SWITCHING DC POWER SUPPLIES

DRAWING NO. 75516 REV. A

SINGLE OUTPUT SPL SERIES SPECIFICATION AND APPLICATION DATA SHEET

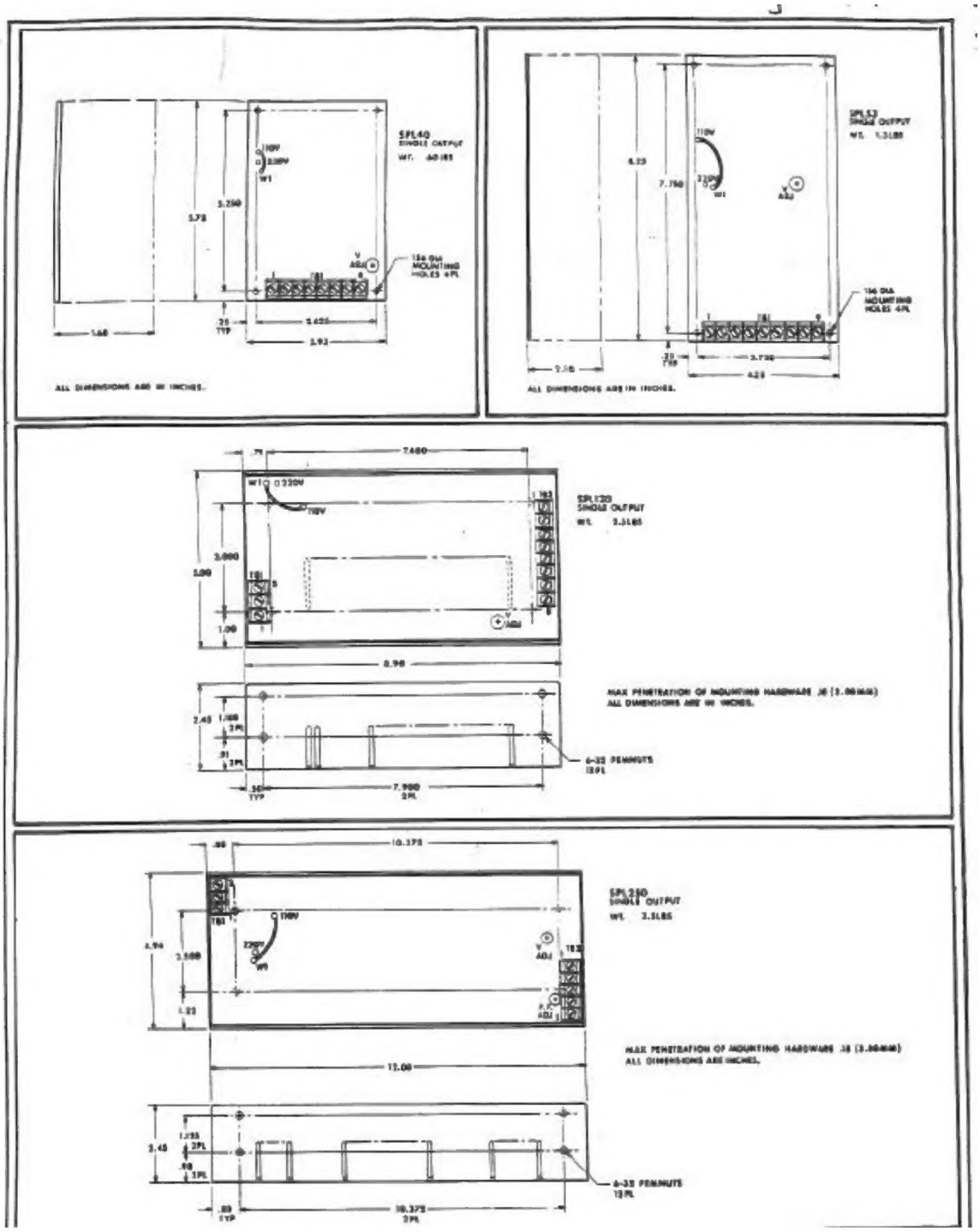
* * SPECIFICATIONS * *

AC INPUT:	Standard dual range: 90-132VAC / 180-264VAC. Factory set for 110VAC (user selectable), 47-63 Hz, single phase. Consult factory for 440 Hz operation.
OUTPUT VOLTAGE:	See Voltage/Current Rating Chart.
OUTPUT POWER:	Continuous rating (unless otherwise noted) SPL40-1xxx series : 40 watts SPL53-1xxx series : 80 watts SPL130-1xxx series: 130 watts SPL250-1xxx series: 250 watts
MINIMUM LOAD:	5% of maximum rated load.
INPUT CONNECTORS:	Barrier terminal blocks; #6-32 screws on .375 inch centers.
OUTPUT CONNECTORS:	SPL40-1xxx, SPL53-1xxx, and SPL130-1xxx models: Barrier terminal blocks; #6-32 screws on .375 inch centers. SPL250-1xxx: Power Output - #10-32 brass studs. Voltage sense, Power Fail, and Inhibit - Barrier terminal blocks; #6-32 screws on .375 inch centers.
INITIAL VOLTAGE:	Factory set to within ±1% of nominal output voltage. Measured at 50% load, at nominal AC line voltage. See Voltage/Current Rating chart for nominal voltages.
ADJUSTMENT RANGE:	5V models: 4.5V to OVP trip point. 12V models: 11V to 16VDC (can be user adjusted for 15V applications). 24V models: 23V to 29VDC (can be user adjusted for 28V applications).
REMOTE SENSING:	Provided on SPL53-1xxx, SPL130-1xxx, and SPL250-1xxx series. See Figure 1.
POWER FAIL:	Provided on SPL250-1xxx series. Signal goes low 10 msec minimum before the output voltage drops 5% at 100% load. Warning time increases to 20 msec minimum at 50% load.
OUTPUT INHIBIT:	Provided on SPL250-1xxx series. Applying >3.0VDC to the INHIBIT pin will turn the output of the power supply off. Requires 3mA of sourcing current (minimum).
EFFICIENCY:	Typically 65% to 75%. Measured at full rated output power and nominal AC input voltage.
BROWN-OUT PROTECTION:	Regulation is maintained down to 90VAC / 180VAC, at full load with no compromise in performance.
HOLD-UP TIME:	20 msec minimum at 110 / 220VAC and 100% load. Hold-up time increases to 40 msec minimum at 50% load. See figure 4.
REGULATION:	See Voltage/Current Rating charts for individual model ratings. LINE: Measured by varying the line voltage from 90-132VAC / 180-264VAC. LOAD: Measured by varying the load current from 10%-100% of full load, at nominal AC line voltage. Voltage is measured at the sense terminals (the load terminals on the SPL40-1xxx).
OUTPUT NOISE AND RIPPLE:	1% PK-PK, 0.3% RMS maximum. See Figure 2.
TRANSIENT RESPONSE:	Recovery time: 500 usec typically for a 50% to 100% load change and recovery to within 1% of initial voltage set point. Maximum excursion: 3% from initial voltage set point.
OUTPUT OVERSHOOT:	No overshoot on turn-on or turn-off.
OVERLOAD / SHORT PROTECTION:	Protected against overload or short circuit. Automatic recovery upon removal of overload or short circuit condition.
OUTPUT OVERVOLTAGE PROTECTION:	Provided on 5V models, set at 6.2VDC ±0.
OUTPUT REVERSE VOLTAGE PROTECTION:	Inherently protected from damage due to application of reverse polarity voltage across DC output terminals.
INPUT CURRENT PROTECTION: AC	input line fuse - internally located. Factory replacement only.
INRUSH CURRENT:	Internally limited by thermistor. Cold start, peak current at 230 vac input: SPL40, SPL53: 9A SPL130, SPL250: 17A
COOLING:	Convection cooling is adequate where non-restricted air flow is available. When operating in a confined area, or the ambient air is over 50ºC, moving air cooling is recommended. See figure 3.
TEMP. RATING:	Operating: 0ºC to +50ºC at full rated output power. Consult factory for operation between +50ºC to +70ºC. Storage: -55ºC to +85ºC.
TEMP. COEFFICIENT:	±0.03%/ ºC typical, ±0.05%/ ºC maximum over temperature range of 0ºC to +70ºC.
VIBRATION:	Per Mil-Std-810C, Method 514, Procedure X, Category G-1.
SHOCK:	Per Mil-Std-810C, Method 516, Procedure V.
WARRANTY:	Covers defective materials and workmanship for 2 years from original delivery (see detailed return procedure on page 2 of this Application Data Sheet).

* * OPTIONS * *

The following options are available for the single output SPL Series. Minimum order requirements may apply - please consult factory for more information.

OVP PROTECTION:	Available for all models.
INPUT/OUTPUT CONNECTORS:	Quick disconnect logs (.25 inch wide) mounted on the barrier terminal block are available for all models. Amp or Molex wafer style connectors (.312 inch centers) are available for SPLA0-1xxx and SPL53-1xxx models.
EMI/SAFETY COVERS:	Available for SPL130-1xxx and SPL250-1xxx.
AC TRANSIENT PROTECTOR:	Available for SPL130-1xxx and SPL250-1xxx.


SPL40
SINGLE OUTPUT
110V
220V
V ADJ
ALL DIMENSIONS ARE IN INCHES.
SPL53
SINGLE OUTPUT
110V
220V
V ADJ
ALL DIMENSIONS ARE IN INCHES.
SPL120
SINGLE OUTPUT
110V
220V
V ADJ
6-32 PEMNUTS
SPL230
SINGLE OUTPUT
110V
220V
V ADJ
6-32 PEMNUTS

* * SAFETY SPECIFICATIONS * *

The Single Output SPL Series of Switching Power Supplies meets or exceeds the following safety agency requirements for dielectric withstand voltage, insulation, creepage and clearance distances:

Underwriters Laboratories : UL 478, 1012
Canadian Standards Association : CSA 22.2
International Electro-Technical Commission: IEC 380, 435
International Commission for Electrical Equipment : CEE 10
Verband Deutscher Elektrotechniker : VDE 0730, 0804, 0805, 0806
Meets SELV requirements - Class I (see note under SPL Series AC Connection Table).

For British BPO requirements, contact factory.

Certification Information: The SPL40-lxxx, SPL53-lxxx, and SPL130-lxxx series are certified to the above safety specifications by Underwriters Laboratories, and TUV Rheinland. The SPL250 is pending approval for safety specifications listed above. Please contact the factory for update information.

* * SPL SERIES DESIGN STANDARDS * *

Dielectric Withstand Voltage, Minimum:
Input to Ground: 1770 VAC RMS Output to Ground: 500 VDC
Input to Output: 3750 VAC RMS

Safety Spacings:
8.0 mm min. between primary and secondary circuitry.
3.0 mm min. between primary and grounded circuitry.

Leakage Current: 0.75 mA maximum, line to ground.

* * EMI SPECIFICATIONS * *

All SPL Series models are equipped with internal line filtering which allows compliance to the conducted emissions limits of FCC Docket 20780 Part 15 Class A, and VDE 0871/6.78 Class A.

FREQUENCY RANGE	150 kHz - 450 kHz	450 kHz - 30 MHz
SPL Series Design Standards	< 63 dBuV	< 57 dBuV
VDE 0871/6.78 Class A	< 66 dBuV	< 60 dBuV
FCC 20870 Part 15 Class A	Not Specified by FCC	< 60 dBuV

* * APPLICATION NOTES * *

A. OVERLOAD PROTECTION uses two levels of current limiting.
If a moderate overload occurs, the first level of current limiting causes the output voltage to drop, but the supply can still put out appreciable current. This allows the power supply to start heavy loads (such as disk drives).
If the overload is severe enough (such as a short circuit), the second level of current limiting is activated, which causes the output to cycle on and off at a very low rate (an audible chirp). The low duty cycle during this mode of protection prevents excessive power from being dissipated in the load, as well as the power supply.
The power supply will recover into a 100% load when the overload is removed.

B. REMOTE SENSE is provided on the SPL53-lxxx, SPL30-lxxx, and SPL250-lxxx series. This feature may be used to compensate for output line losses and provide for a remote point of regulation. Load lines must be sized to drop no more than 0.5V (the less the better). The power supply will compensate for the line losses by raising the output voltage of power supply. Excessive DC output line losses may affect current limiting, AC line voltage dropout, OVP margin, stability, ripple and noise. All leads between the power supply and the load should be routed close together to minimize stray noise pickup.

C. POWER FAIL is provided on the SPL250-lxxx series only. The output is open collector, and requires an external pull-up resistor (to less than 30VDC). The output will sink 5 milliamps. The warning time is user-adjustable. To change this delay from the factory set value of 10 milliseconds at 100% load:

1) Select the desired time delay from the graph in figure 5, and note the line voltage associated with it.
2) Load the power supply, and adjust the AC line voltage to the value on the graph.
3) Adjust the POWER FAIL potentiometer to give a low POWER FAIL signal.

Note: The time from loss of AC power to the POWER FAIL output going low is variable, and deceases with decreasing line voltage, or increasing load.

* * VOLTAGE / CURRENT RATING CHART * *

Model	Volts	Amperes	Regulation % Load / Line
SPL40-lxxx Series			
SPL40-1005	5.0	8.0	1.0 / 0.2
-1012	12.0	3.3	
	(15.0)	(2.7)	
-1024	24.0	1.6	
	(28.0)	(1.4)	
SPL53-lxxx Series			
SPL53-1005	5.0	16.0	1.0 / 0.2
-1012	12.0	6.7	
	(15.0)	(5.3)	
-1024	24.0	3.3	
	(28.0)	(2.8)	
SPL130-lxxx Series			
SPL130-1005	5.0	26.0	1.0 / 0.2
-1012	12.0	11.0	
	(15.0)	(9.0)	
-1024	24.0	5.5	
	(28.0)	(4.5)	
SPL250-lxxx Series			
SPL250-1005	5.0	50.0	1.0 / 0.2
-1012	12.0	21.0	
	(15.0)	(17.0)	
-1024	24.0	10.0	
	(28.0)	(7.0)	

Notes:
() Outputs listed in parentheses are obtained by user adjustment.

* * SINGLE OUTPUT SPL SERIES CONNECTION TABLE * *

Model	Pin	Function
SPL40-lxxx	TB1-1	Neutral
	-2	Line
	-3	Ground
	-4	N/C
	-5	+Out
	-6	+Out
	-7	-Out
	-8	-Out
SPL53-lxxx	TB1-1	Line
	-2	Neutral
	-3	Ground
	-4	-Out
	-5	-Out
	-6	+Out
	-7	+Out
	-8	-Sense
	-9	+Sense
SPL130-lxxx	TB1-1	Ground
	-2	Neutral
	-3	Line
	TB2-1	+Out
	-2	+Out
	-3	+Out
	-4	-Out
	-5	-Out
	-6	-Out
	-7	+Sense
	-8	-Sense
SPL250-lxxx	TB1-1	Neutral
	-2	Line
	-3	Ground
	TB2-1	+Sense
	-2	-Sense
	-3	Power Fail
	-4	Inhibit
	-5	Return-For Inhibit and Power Fail
	+OUT	+Out
	-OUT	-Out

ATTENTION: The SPL Series power supplies are VDE Class I devices, and require the use of a ground lead, properly fastened to earth.

* * WARRANTY * *

POWER ONE warrants each power supply that does not perform to published specifications, as a result of defective materials or workmanship, for a period of two (2) full years from the date of original delivery.

POWER ONE assumes no liabilities for consequential damages of any kind through the use or misuse of it's products by the purchaser or others. No other obligations or liabilities are expressed or implied.

Specifications subject to change without notice.

* * PRODUCTS RETURNED FOR REPAIR * *

Please follow this procedure when returning products for servicing:

1. Contact POWER ONE's Customer Service Department for authorization to return products:

POWER-ONE SWITCHING PRODUCTS
847 FLYNN ROAD
CAMARILLO, CA 93010

PHONE: (805) 482-0757
TELEX: 752083

2. A Returned Material Authorization (RMA) will be issued and must appear on all correspondence and packages.

3. Products must be returned freight prepaid. Products returned freight collect or without an RMA number will be rejected and returned freight collect.

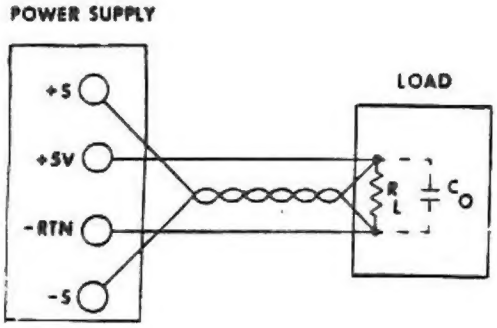


Figure 1: RECOMMENDED LEAD ROUTING FOR REMOTE SENSE OPERATION

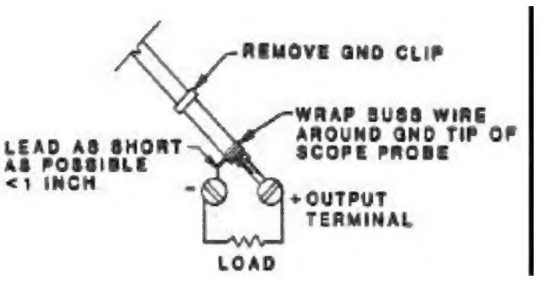


Figure 2: NOISE MEASUREMENT TEST SET-UP
Use an oscilloscope limited to 20MHz bandwidth, with a 10X probe and ground lead as shown. Ground lead must be as short as possible to reduce stray pick-up. Measure noise directly at the output terminals.

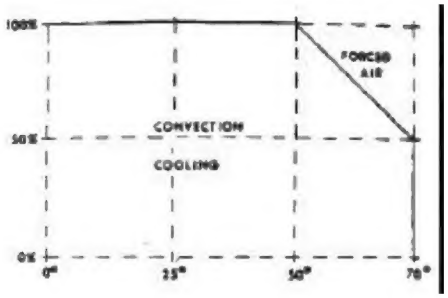


Figure 3: TEMPERATURE DERATING
Forced air cooling is recommended for ambient temperature above 50°C. When in doubt, the maximum metal case temperature on any semiconductor may not exceed 110°C.

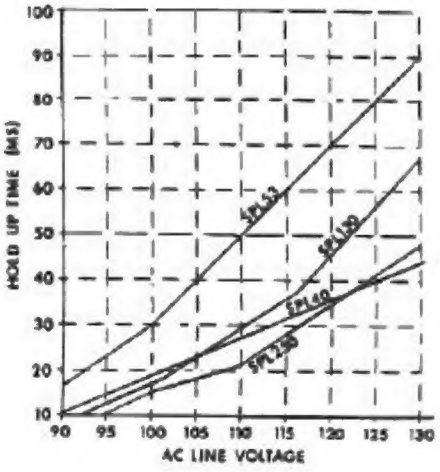


Figure 4: MINIMUM HOLD-UP TIME (STORAGE TIME)
The above graph shows the minimum hold-up time available at the given line voltage and 100% load.

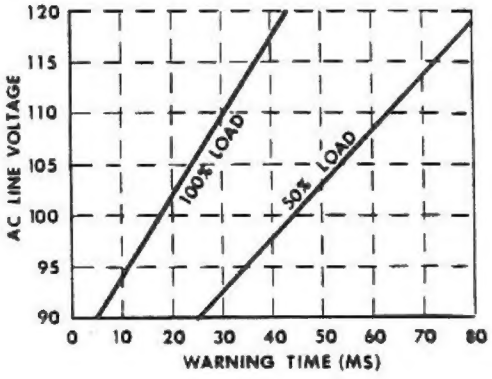


Figure 5: POWER FAIL TIMING CURVE (SPL250 only)
Typical warning times from the moment when the POWER FAIL output goes low, until the power supply falls out of regulation. See Application Note C for further information.